

BULLETIN

OF THE

BROOKLYN ENTOMOLOGICAL SOCIETY

VOL. XXVIII

JUNE, 1933

No. 3

DRAGONFLIES OF THE GENUS *TETRAGONEURIA*.

BY WM. T. DAVIS, Staten Island, N. Y.

An attempt has been made in this paper to separate the dragonflies of the genus *Tetragoneuria* (Hagen, Neuroptera, North America, p. 140, 1861) that the writer has been able to examine. In the "Handbook of the Dragonflies of North America" by Needham and Heywood, is the statement that "The species are all about one size and one color pattern of body and are very variable in the markings of brown upon the wings. Many species have been named because of very slight differences. We can find no good use for all these names since our specimens seem to transgress all the boundaries that have been indicated. The last important paper on the genus is that of Muttkowski (1911) [and 1915] in which he endeavors to define eleven species. We recognize five, that are separable . . ." p. 179.

In the present paper we have recognized thirteen named forms as species, subspecies and one variety. There are no doubt several more that might have been separated. No specimens of *costalis* Selys have been available and it has not been included in the table, but is added at the end of the paper. *Calverti* has been identified from the description only.

The "Studies in *Tetragoneuria*" (1911 and 1915) by Richard A. Muttkowski, Bulletin of the Wisconsin Natural History Society has been the chief source of reference, but the writings of Dr. Philip P. Calvert, R. Heber Howe, Jr., C. H. Kennedy and Edward B. Williamson, have been consulted together with other literature cited under the specific names. I am particularly indebted to Mr. E. B. Williamson for the privilege of examining numerous specimens from which some of the photographs have been made rather than from material in my own collection. Other acknowledgements are included under the specific names.

The figures of abdominal appendages have been drawn by Mr. Hans L. Stecher from a number of sources; from the insects, and

also from the published figures of the types, etc. In separating the species of *Tetragoneuria* the shape of these appendages is of prime importance, but whether the insect has a broad or a slim abdomen is also a character of much value. In order to arrive at a more accurate knowledge of *Tetragoneuria* it will be advisable in the future to collect many hundred specimens from as many localities as possible, and prepare or spread them so that they may be viewed in a comprehensive manner. Specific differences with such material often become apparent.

TETRAGONEURIA HAGEN, 1861

A Superior appendage of the male not declined at tip and without superior ante-apical spine or tubercle.

B Male superior appendages with ventral angle at basal third.

C Male superior appendages, when viewed from above, curved, and with the apical third bent outward.

D Abdomen of male rather broad, often much flattened.

E When viewed in profile the top and bottom lines of the male appendages beyond the ventral angle are not as parallel as in *semiaquea*, and the rounded extremity is more gradually attained. Length of abdomen about 30 mm., hind wing about 30 mm. male appendages about 3 mm., female appendages about 1.5 mm., vulvars flattened, divaricate, the tips divergent. Thoracic pile often conspicuously gray.

Brown of hind wing reaching the base of the triangle or less. Maine and Minnesota to Oklahoma and North Carolina. Type loc. Mass.

cynosura Say.

Brown of hind wing filling first to third antecubitals and thence diagonally across wing to lower end of membranula; transparent area between radius and cubitus small or wanting. New York, New Hampshire, New Jersey, Georgia, Iowa. Type loc. Bluffton, Ind.

cynosura sub. species *simulans* Mutt.

EE When viewed in profile the top and bottom lines of the male appendages beyond the ventral angle are more parallel than in *cynosura* and the rounded extremity is more suddenly attained. Smaller; length of abdomen about 25 mm., hind wing about 26 mm. Thoracic pile browner than in *cynosura*.

Brown of hind wing filling antecubital spaces to nodus, or at least the first four antecubitals, and thence diagonally across wing to lower end of membranula. Usually the transparent area between radius and cubitus at base of wing, not conspicuous. Coast from New England? to North Carolina and Georgia (type loc.).

semiaquea Burmeister

Brown of hind wing not reaching the nodus. Type loc. Georgia.

semiaquea subspecies *calverti*

Muttkowski

DD Abdomen rounder and proportionally more slender in comparison with *cynosura* and *semiaquea*; sides of abdomen nearly parallel.

Wings without brown markings; stigma paler and longer than in *cynosura*; ventral angle at basal third of superior appendage more obtuse than in *cynosura*. Length of abdomen, male 33-34 mm., female 33-34 mm.; of hind wing, male 30-31 mm.; female, 31. Female appendages 2 mm. West Palm Beach, Fla. (type loc.), Georgia, Louisiana *stella* Williamson

Both fore and hind "wings with brown spots at antenodal intersections, sometimes with spaces filled." Length of abdomen, male 28-31 mm., female 31 mm.; hind wing, male 27-31 mm., female 30 mm. "Male appendages intermediate between *cynosura* and *stella*, though more nearly related to the latter." "The female appendages are longer [about 2 mm.] than those of *cynosura* and ~~less~~ spiculiform. Vulvars slender and recurved, not flattened and divaricate as in *cynosura*, the tips sub-

parallel." Round Mountain, Blanco Co., Tex. (type loc.). Cypress Mill, Texas, Kansas, and Florida. (*costalis*?)

petechialis Muttkowski

- CC Male superior appendages when viewed from above more straight and with tips not bent outward; the inferior angle produced.

Abdomen of male slender, 29–31 mm., segments 2 and 3 inflated, 3 constricted at middle; fore wings without color; hind wings 31 mm.; male appendages 3.5 mm.; female appendages 2 mm. Wister, Oklahoma (type loc.).

williamsoni Mutt.

Abdomen 30 to 34 mm.; hind wing 30–33 mm.; female appendages 3–3.3 mm. Male appendages seen in profile somewhat like those of *cynosura*, but with a longer, slightly produced angle. The vulvars of the female are "like those of *spinigera*. Appendages somewhat stouter and longer." Resembles *cynosura* but the produced angle on the male appendages appears to effectually separate them. Solon Springs, Douglas Co., Wisconsin (type loc.), Michigan, Maine and Massachusetts.

morio Muttkowski

- BB Male superior appendages with ventral spine at basal third; no ventral angle.

T-spot of head present. Color on hind wing usually confined to first antecubital space (often to its posterior part) and narrowly along margin of membranula. Length of abdomen 30–34 mm.; hind wing 30 to 33 mm. Female appendages about 3.5 mm.; vulvars with the tip parallel. Maine, New York, Indiana, Wisconsin, Washington, "Canada" (type loc.) *spinigera* Selys
Color on hind wings usually filling first two or three antecubital spaces, extending thence obliquely across the wings to lower extremities of the membranule. Female can be told from *cynosura* var. *simulans*, which it resembles, by its longer appendages and usually larger size. Hudson Highlands, N. Y. ♂ and Newfoundland, N. J. ♀, allotype and type localities
spinigera var. *suffusa* Davis, new variety

- AA Superior appendages of the male slightly declined at the tips beyond a superior ante-apical spine or tubercle.

Male superior appendage when seen in profile with a dorsal ante-apical sharp spine; apex of appendage blunt; ventral surface with angle at basal third; no ventral spine or tubercle. Female appendages 2 mm. in length; vulvars with the tips parallel. Hind wings usually with four antenodal cross veins. Georgia (type loc.), New Jersey *spinosa* Hagen

Male superior appendages when seen in profile with dorsal ante-apical elevation or tubercle; apex of appendage obliquely truncate; ventral surface with tubercle near basal portion. Male superior appendages 3 mm. Female appendages 2.3-2.7 mm.; vulvars with the tips parallel. Hind wings usually with five antenodal cross veins. Maine, New York, Wisconsin, Ontario, California, Washington (type locality). . . *canis* Mac Lachlan

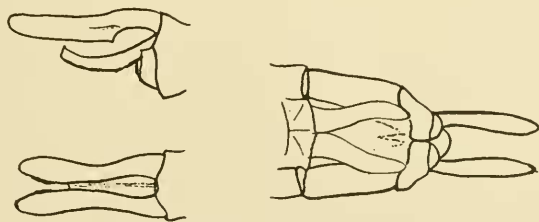
Tetragoneuria cynosura (Say) Selys., Pl. IX, fig. 1.

Jn. Acad. Philadelphia 8, p. 30, 1839.

Syn. *lateralis* Burmeister Handb. Ent. 2, p. 847, 1849.

Syn. ? *basiguttata* Selys., Bull. Acad. Belg. (2) 31, p. 271. 1871.

The original description contains the statement: "anal processes longer than the caudal and ultimate segment of the abdomen together a little dilated and curved outwards towards the tip, which is rounded, abruptly narrowed beneath towards the base; inferior process two-thirds the length of the superior ones." The anterior wings are described as immaculate, and the "posterior pair with the basal, costal, and subcostal cellules fuscous, and an irregular fuscous spot between them and the anal angle." These features, together with the given habitat "Massachusetts," fixes the identity of the species, which with *semiaquea* Burm., was described in 1839.



T. CYNOSURA, SAY

Burmeister's *Epophthalmia lateralis* is described very briefly, the male type coming from Philadelphia ("female not seen by

me"). As he states that the male cerci are elongate, clavate and curved outwardly, there can be no reasonable doubt but what *lateralis* is a synonym of *cynosura*.

Cordulia basiguttata was described as a race ? of *cynosura* by de Selys. "Abdomen, male 25; female 29. Hind wing, male 26; female 30. Shape more slender; abdomen almost cylindrical, not depressed, narrower behind the constriction. Coloration of the body darker, as are also the legs and the anal appendages; the blackish band of the base of the front extending over almost the entire upper side of the front in the emargination. The basal droplet [spot] of the hind wings shorter, but black in both sexes. The spot of the same color, placed close to the membranula, short in the male, absent in the female. Country: The male from Florida (Col. Selys), the female from Canton near Boston, N. B. The *Cordulia cynosura* and *semiaquea* seem to be so variable that I have not dared regard this race as a distinct species, the more so since it is not quite certain that the male belongs to the female with which I place it. The age of the specimens and their mode of preparation may also contribute to give the abdomen an appearance more or less compressed or depressed."

In his notes on synonymy (1915) Muttkowski states that: "The reference of this form to *cynosura* is based on Dr. Ris' notes," and adds that the female from Canton near Boston is "without doubt a true *cynosura*, while the male from 'Floride' may belong to some other species, probably *stella*." However, *stella* is usually larger than the measurements given in the above description for the male and it is also generally of a lighter color. We think that the male may prove to be the same as *williamsoni* which is smaller, has a slender, cylindrical abdomen and wing maculation as described.

The writer has several times seen members of this widely distributed species in great numbers, notably in Northern New Jersey in Passaic County near Buckabear and Cedar Ponds, and also along the shore of Conesus Lake, Livingston County, N. Y. On May 28, 1910, there was a remarkable gathering of this species along the road leading from Newfoundland, N. J., to Cedar Pond and the air was full of these dragonflies. On one small dead bush I counted twenty-two individuals, and there were other bushes and stems of plants that also had a great many resting upon them. On June 23, 1916, on the shore of Conesus Lake, Dr. Harry H. Knight captured thirty-one individuals by simply swinging his net about a bush where the dragonflies had settled, many of them being still quite immature. Twenty speci-

mens of this series are in the writer's collection. Six of them are typical *cynosura* with the hind wings slightly infuscated at the base, while fourteen belong to the subspecies *simulans* Muttkowski, in which the hind wings are more heavily infuscated at the base, the darkened portion including the first two or three antecubital spaces and extending thence diagonally across the wings to the end of the membranule. There were no intermediates.

On Staten Island and about New York City generally, only typical *cynosura* has been collected. Mr. Williamson has noted on the envelope containing two typical male *cynosura* collected at Viberg Lake, Allen Co., Indiana, June 11, 1916: "Eight *simulans* and four *cynosura* taken today; no intermediates."

In the sixty specimens of *cynosura* and *simulans* in the writer's collection there are no intermediates, nor did I find any in the extensive series from Massachusetts, Connecticut and Vermont, kindly sent for examination by the late Mr. R. Heber Howe, Jr.

Tetragoneuria cynosura subspecies *simulans* Mutt., Pl. IX, fig. 2.

Bull. Wis. Nat. Hist. Soc. (2) vol. 9, pp. 95, 106, 1911.

diffinis Selys, Bull. Acad. Belg. (2) 31, p. 272, 1871;

simulans syn. of *diffinis*?

In the original description *simulans* is distinguished by having "Hind wings with markings reaching to tip of triangle and beyond," instead of, "Hind wings with markings reaching the base of the triangle or less," as in typical *cynosura*.

Muttkowski (1911) uses the trinomial name, "*Tetragoneuria cynosura simulans*," for this insect, but as both forms occur together over a part of their range, especially inland, *simulans* is probably not a geographic race of *cynosura*, and I think should be designated as a subspecies unless it can be shown in the future to be distinct.

This insect has been frequently identified as the *semiaquea* of Burmeister (1839), described from Savannah, Georgia, as, for instance, when de Selys (1871) states that he has that species from "Ga., S. C., Washington, Fla., Mass." *Simulans* is larger than *semiaquea* from the southeastern Atlantic States, and the hind wings are not as broadly marked with brown at the base.

In 1871 de Selys states: "I believe that my *diffinis* described from an example in the British Museum labelled Nova Scotia, is nothing but an individual variety of *semiaquea*. It differs only because the discoidal triangle of the upper wings is free. M. Hagen has communicated an example from Massachusetts showing the same aberration."

As mentioned above the circumstance of the discoidal triangle being free is not of very much importance, but *diffinis* must have had the basal part of the hind wings browned or it would not have been considered with *semiaquea*, and as the type came from Nova Scotia, it is likely to have been what is here considered *simulans* Muttkowski (1911), and not *semiaquea* at all. In the second part of his "Studies in Tetragoneuria," (1915), Muttkowski lists *diffinis* as a synonym of *simulans* and adds "insufficient diagnosis." He also states: "This form has hitherto not been noted in the synonymy. Its characterization although vague when taken together with de Selys' synonymical notes is sufficiently distinct to merit attention."

As has been stated under *cynosura* this species or subspecies has not been found on Staten Island, but a few miles to the north, at Ramsey, Hewitt and Newfoundland, New Jersey, and Ramapo, Greenwood Lake, and Pine Island, New York, it occurs with typical *cynosura*. At Conesus Lake, New York, on June 23, 1916, *simulans* exceeded typical *cynosura* in numbers. Though closely associated, I found no intermediates.

Tetragoneuria semiaquea (Burmeister), Pl. IX, fig. 3.

Handb. Ent., 2, p. 858, 1839; ♀ (*Libellula*).

Syn. *complanata* (Rambur), Ins. Neur., p. 145, 1842; (*Cordulia*), ♀ ♂, Coll. Selys.

The original description calls for an insect with the segments of the abdomen as broad as long or still broader, the entire abdomen flat, always broader than thick, narrowed posteriorly. When seen in profile not strikingly thicker at the base but becoming gradually thinner outwardly from the base. "Wings hyaline the hind ones broadly fuscous, with a transparent spot and some of the veins infuscate; abdomen with fulvous lateral spots. Long 1" 3'" ♀." The type came from Savannah, Georgia.

In 1842 Rambur described his *complanata* from "North America" as having the "Wings transparent, the hind ones a little widened, with a broad, brown-rufus reticulate spot which sometimes covers almost half the wing in the female but which in the male sometimes disappears entirely." His description may embrace what are now considered several different species of *Tetragoneuria*, but the "brown-rufus, reticulate spot which sometimes covers almost half the wing," can we think, refer only to what is here considered typical *semiaquea*.

In 1871, de Selys stated that *semiaquea* is so near to *cynosura*

that a comparison therewith will enable an understanding of the differences better than a regular description. He states that he has it from Ga., S. C., Washington, Fla., and Mass. From his localities and comparative description it is possible that he included *simulans* and *calverti*.

In 1911 Muttkowski stated: "This species hitherto known as *complanata* Rambur and as representing the extreme of the *cynosura-semiaquea-complanata* series, I regard as distinct. It is essentially an Atlantic coast species covering the region from Massachusetts to Georgia [Massachusetts records are doubtful].

"Its main distinction from *cynosura* and *simulans* is the smaller size and the wing markings, though some minor points exist such as the largely brown pile of the thorax-grayish-white in *cynosura*—and the more marked tubercle on the superior appendix of the male.

"Head, thorax and abdomen of typical coloration. T-spot absent, never more than the stem visible in black. Thorax with pile largely brown, so that it is little apparent. The lateral stripes occasionally with a metallic glint."

In 1915, Muttkowski states, referring to *cynosura*, *simulans* and *semiaquea*: "The synonymy of some of the forms is undoubtedly somewhat involved owing to the peculiar nomenclatural interchange in early descriptions, which have been variously followed by authors . . . All of the material of de Selys under *T. complanata* reverts to *T. semiaquea*; that under *T. semiaquea*, as stated above, is insufficiently diagnosed to permit accurate determination. It should be noted that it presents certain peculiarities especially exhibited by specimens from Massachusetts, which should make a detailed study of a long series from Massachusetts of decided interest."

In *Psyche* for March, 1895, Prof. Albert P. Morse, commenting upon *Tetragoncuria cynosura* and its varieties as found in Massachusetts, states: "There is another species found in the Southern States, having the fuscous of a more reddish hue, and even wider in extent, which presents differences in abdominal appendages. This is perhaps the true *semiaquea*."

Typical *semiaquea* has been collected by the writer in North Carolina in April, both at Southern Pines and about Wilmington, mainly at Greenfield Pond. An example is figured on the accompanying plate, and it will be noted, that the dark colored portion of the hind wing reaches beyond the nodus in the central portion of the wing in the cells bordering M₃.

Tetragoneuria semiaquea subspecies *calverti* Mutt.

Bull. Wis. Nat. Hist. Soc. vol. 13, p. 53, June, 1915.

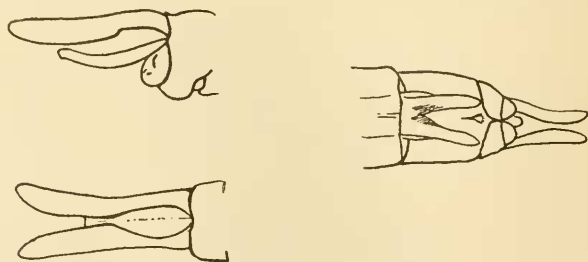
In the original description it is stated that the markings of the hind wings reach the nodus and beyond in *semiaquea*, while in *calverti* the markings do not reach the nodus. It is to be regretted that "Prof. Calvert's valuable material has been completely destroyed only a single *T. stella* escaped destruction," as related by Muttkowski in his 1915 paper, and an effort should be made to collect *calverti* in the type locality, which we understand to be Thomas County, Georgia. We have, however, specimens from much further north than Georgia that answer the description of *calverti*.

Tetragoneuria stella Williamson. Pl. IX, fig. 4.

Williamson (in Muttkowski paper) Bull. Wis. Nat. Hist. Soc. Vol. 9, pp. 95-99, 1911, pl. 6 (wings).

Muttkowski, Bull. Wis. Nat. Hist. Soc. Vol. 13, pp. 49, 58, 59, 1915.

In the original description the male abdominal appendages are described as follows: "Superior appendages seen in profile spatulate, with an obtuse inferior angle at one third the length, this angle inconspicuous; if the appendages of *stella* and any of the *cynosura* group are compared the differences in the superior appendages seen in profile are striking—*cynosura* high arched dorsally and excavated ventrically at the base, with a resultant prominent ventral angle, and a decidedly unsymmetrical outline; *stella*, on the other hand, without this arching and excavation, and with an outline almost symmetrical." "In Dr. Ris' opinion *stella* is quite distinct from all the *cynosura* group by the form of the abdomen (narrow, not spindle shaped), by the color of the abdomen, and by the superior abdominal appendages of the male, which are longer and have a second distal dilation" (Williamson).



T STELLA, WILLIAMSON

In addition to the differences in the shape of the superior appendages in the males of *stella* and *cynosura*, noted by Williamson, I observe that the stigma of both fore and hind wings are longer in *stella* than in *cynosura*; also the insect is usually much lighter in color.

In his notes on synonymy, 1915, under *T. basigutta* Selys, described from "male from Florida (Coll. Selys); the female from Canton near Boston," Muttkowski states: "The female mentioned by de Selys is without doubt a true *cynosura*, while the male from 'Floride' may belong to some other species, possibly *stella*." The original description of *basigutta* fits more nearly *williamsoni* in size, color, etc., and de Selys' male may have been of that species.

The male figured on the accompanying plate, is from Rockledge, Fla., March 2, 1904. It is one of the specimens from which the original description was prepared and kindly loaned to me by Mr. E. B. Williamson. Also from the Williamson collection we have examined the following six examples from Florida: St. Petersburg, March 24, 1913, 2 ♂; Moore Haven, March 29, 1921, ♂ (J. H. Williamson); Palmdale, April 3 and 6, 1921, 2 ♂, ♀ (J. H. Williamson). In the collection of Mrs. A. T. Slosson there is a male from Biscayne Bay, Florida.

Tetragoneuria petechialis Muttkowski. Pl. IX, fig. 5.

Bull. Wis. Nat. Hist. Soc., Vol. 9, pp. 95, 101, 1911.

In the original description of the typical material from Texas it is stated that the abdomen is long and slender as in *stella*, segments two and three moderately dilated. "Segment 8 as long as 9+10. Dorsum black, a yellow stripe occupying the lateral fifth of each side of 3 to 9, reduced on the posterior segments. Male appendages intermediate between *cynosura* and *stella*, though more nearly related to the latter . . . Wings hyaline, membranule white, slightly fumose at the lower end. Fore wings with small basal spot in C and Sc half way to or reaching the first antenodal, the first and second antenodals with a small fuscous spot surrounding the intersection at Sc. A linear spot surrounding the nodus. Hind wings with costal and subcostal streak half way or to the first antecubital. All antenodals with fuscous at the intersections, nodus with linear spot. A brown spot in the cubital space at the extreme base reaching to the marginal vein. A spot in the lower half of the anal triangle, following the oblique vein which divides this triangle, or filling the lower half. Costa of the fore wings yellow at base . . .

This species is at once distinct from the others by the narrow abdomen, the form of the appendages and the conspicuous spots at each antenodal of the hind wing." Muttkowski, 1911.



T. PETECHIALIS, MUTTKOWSKI

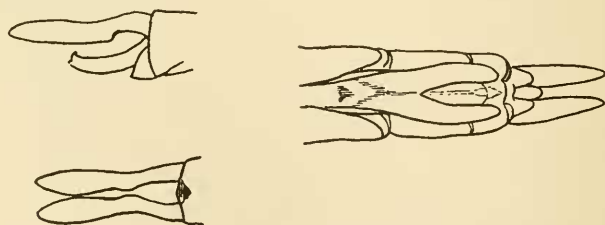
In the Bulletin, Kansas University, 1917, Clarence H. Kennedy shows that there is considerable variation in the color pattern of the wings in this species. In some specimens the ventral angle on the superior appendages in the male, is not as prominent as in the figure copied from Kennedy.

The specimen here figured is Paratype C 4., Cypress Mill, Texas, April 10, 1895 (1893 of Muttkowski's paper), kindly loaned to me by the Acad. Nat. Sciences of Philadelphia.

Tetragoneuria williamsoni Muttkowski. Pl. X, figs. 1 and 2.

Bull. Wis. Natural History Soc. (2) 9, pp. 95, 122. 1911.

Through the kindness of Mr. Williamson we are enabled to figure the male type from Wister, Oklahoma, June 3, 1907.



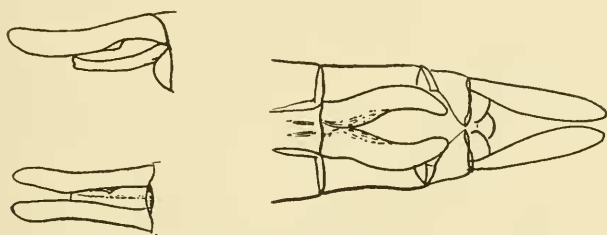
T. WILLIAMSONI, MUTTKOWSKI

A second male from Tampa, Florida, February 28, 1921 (E. L. Bell), Davis collection, is also figured. These illustrations will show the character of the wing maculation, the slender abdomen, and the rather long and slender appendages.

Tetragoneuria morio Muttkowski. Pl. X, fig. 3.

Bull. Wis. Natural History (29), pp. 96, 125, 1911.

The original description states: "Male appendages in dorsal view like those of *spinigera*, that is twice curved and with the tips approximated. In lateral view somewhat like *cynosura*, but with a longer, slightly produced angle, and no lateral ridge." "Wings hyaline, fore wings without color, hind wings with brown reaching the first antenodal in C and Sc. Brown at the intersections of the arculus, at the ends of the triangles and anal veins. A large blot in the lower anal triangle and the adjoining two series of veins."



T. MORIO, MUTTKOWSKI

The above description was made from the male type from Solon Springs, Wisconsin, a male from Maine now in the Williamson Collection, and two females, one from Maine and the other from Detroit, Mich. Through the kindness of Mr. T. E. B. Pope of the Milwaukee Museum, I have been able to examine the type and the two lower left figures in Muttkowski's cut, here reproduced, fairly represent the appendages. Muttkowski states that they are from the type. Mr. E. B. Williamson writes: "Of Muttkowski's figs. p. 125, the two lower left hand agree fairly well with the paratype which does not agree at all with the right hand figures." We do not know the source of the lower right hand figures.

In the original description the species is recorded from Wisconsin, Michigan and Maine. In his Manual of the Odonata of New England, Dr. Howe adds New Hampshire and Massachusetts, and states that it is rare.

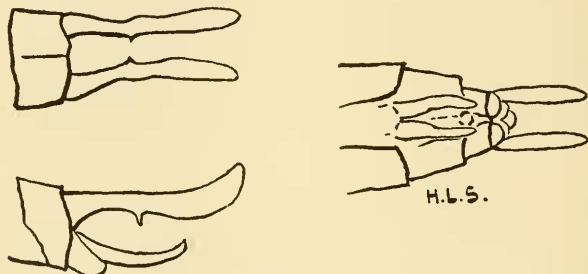
Tetragoneuria spinigera (Selys) Selys. Pl. X, figs. 4 and 5.

Bull. Acad. Belg. (2) 31, p. 269, 1871.

Syn ? *costalis* Selys, Bull. Acad. Belg. (2) 31, p. 273, 1871.

Syn. *indistincta* Morse, Psyche. 7, 210, 1895.

The original description states that in the male: "The upper anal appendages bear below on the inner side a long spine which is inclined downwards (instead of a single angular tubercle)," and that there is: "A brown basal droplet in the fore wings between the subcostal and the median vein." The female was unknown to de Selys.



T. SPINIGERA SELYS

Muttkowski in 1911, states: "This species is more easily distinguished than any of the preceding, notably by the male appendages which have an inferior spine, and by the female vulvars which approximate each other also by the female appendages which usually reach a length of 2.7 to 3 mm." He also quotes a letter from Dr. Calvert giving the results of his examination of the female type of *T. indistincta* Morse from Winchendon, Mass., and the conclusion reached that it is probably the same as *spinigera*. Muttkowski adds: "In placing *indistincta* with *spinigera* I base its identity upon the black T-spot, the length of the appendages and color description, all of which agree perfectly with *spinigera*."

In the original description of *indistincta* it is stated that "the basal part of median space and basal antecubital cell of each series fuscous." Dr. Calvert states, as cited above, that this "refers only to the hind wings, not to the front, on which there is merely a very small brown spot in the subcostal space."

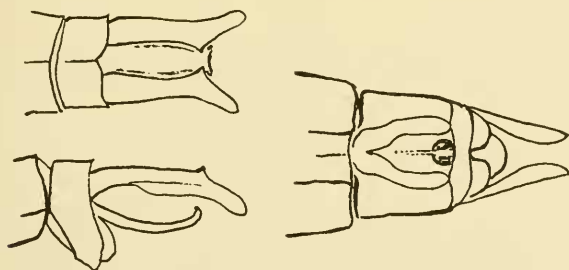
The writer has collected *spinigera* at Newfoundland, N. J., in May and June; also at Portageville, Wyoming County, and at West Point, N. Y., in June. From the localities given by Muttkowski and in the writer's experience, this species appears to be of northern range. I have no records from the southern states.

Tetragoneuria spinigera var. *suffusa* new variety. Plate XI, figs. 1 and 2.

Among the specimens of *spinigera* there is a female from Newfoundland, N. J., May 28, 1910, and a female from West Point, June 4, 1916, that differ from typical *spinigera* in the same way that subsp. *simulans* Muttkowski differs from typical *cynosura* Say, namely, in having the dark markings of the hind wings reaching the triangle or beyond. There is also in the writer's collection a male of this variety, here designated as *Tetragoneuria spinigera* var. *suffusa* from Hudson Highlands, June 25, 1916 (F. M. Schott). The type from Newfoundland, N. J., and the male from the Hudson Highlands are figured on the accompanying plates. Figure 5, Plate X, may be considered an intermediate.

Tetragoneuria spinosa (Hagen) Selys. Plate XI, figs. 3 and 4.
Bull. Acad. Belg. (2) 45, p. 188, 1878.

The original description states that this species described from Georgia is: "Related to *cynosura* and *spinigera* male. In size it is nearest to *spinigera*. It differs from that species as also from the five allied species or races in the upper anal appendages which have above on their last quarter a short, thick, but sharp tooth, very distinct if one looks at the appendage in profile. *Spinigera* has no such tooth, but has a spine on the first third below. The other species, *cynosura*, *semiaquea*, *complanata*, have neither of these spines."



T. SPINOSA, HAGEN

This well-marked species, of which we figure a male from Clementon, N. J., April 27, 1903 (V. A. E. Daecke), and a female from Old Bridge, N. J., April 23, 1910 (Wm. T. Davis), is rare in collections. A male now in Mr. Williamson's collection was also captured at the time the female was taken at Old Bridge.

Tetragoneuria canis MacLachlan. Plate XI, fig. 5. Ento. Mo. Mag. 23, p. 104, 1886.

The original description states: "Appendages black. The superior appendages (3 mm.) not quite as long as the 9th and 10th segments combined: viewed above, they are straight, convergent, and sub-cylindrical, but somewhat before the apex they dilate, and become almost two-branched, the inner branch forming a short triangular tooth, the outer being much longer, curved outwardly, and stout and obtuse at the apex, its inner edge excised: viewed from the side, the appendages are very straight, gradually thickened, with a triangular production or tooth near the middle of the lower edge; the apical portion in this position may be compared in form to a dog's (or wolf's) head, with long profile and short erect ears. Inferior appendage extending to the portion of the superior, where these latter become suddenly altered in form (yellowish internally above), rather broad, slightly curved upward, the apex broadly excised, leaving the outer angles very prominent."



T. CANIS, MACLACHLAN

This species has a wide distribution extending across the continent from Maine and New York to Washington and California; also in Canada. The male figured is from Napa, California, June 9, 1914 (C. H. Kennedy Collector). The writer captured a male at West Danby, N. Y., May 30, 1915.

In Bulletin 47, N. Y. State Museum, 1901, plate 22, fig. 2, Dr. Needham, under the name of *Tetragoneuria spinosa* (referred to *canis* by Muttkowski) gives an illustration of a female which he states "exhibits a singular type of coloration for this genus. The wings were of a rich flavescent brown, with spots of black on a number of the antenodal crossveins" of the hind wings. The figure is said to be "nat. size," but as the insect is shown as having an expanse of wing of 100 mm., it is remarkable in that particular also.

Tetragoneuria costalis (Selys) Selys. Bull. Acad. Belg. (2) 31, p. 273, 1871.

Type ♀, British Museum, L. C. (2) 37, p. 20, 1874, notes.

Costalis is at least a variety or race and may be a species, but

this cannot be determined at this time for lack of specimens from Georgia.

It was considered a subspecies of *cynosura* by de Selys, but he says that it differs "in having the costal margin of the four [4] wings opaque brown between the costal vein and median to the nodus, and in the same manner to the pterostigma, between the costa and the principal sector, as also the hypertrigonal space. In the hind wings the brown basal spot against [or close to] the membranula does not exist but one notices the two small brown drops of the extreme base." The type from Georgia, America, was stated to be in the British Museum.

On pages 132 and 133 of his 1911 paper, Muttkowski published a more detailed description of the type of *costalis* from a letter from W. F. Kirby, June 14, 1911. From this description we learn that the appendages are "straight, black, 4.5 mm. long," and that there is a "broad subhyaline brown bar extending along the whole costal and subcostal areas of all the wings as far as, and including the cell. The lower basal cell, the upper more faintly, and the space above the upper sector of the arculus to the level of the nodus, the space above the triangle, and even the triangle itself on the hind wings, are less deeply stained with smoky brown."

Muttkowski adds: "It is chiefly because of the length of the female appendages that I regard this species as distinct. These are the longest of any known species of *Tetragoneuria*, the nearest species *spinigera*, reaching 3.3 mm." He thinks it is not closely related to *cynosura*, but more likely to *spinigera*, and probably *spinosa* (of which the female is unknown to me)."

The appendages of the female *spinosa* taken at Old Bridge, N. J., are but 2 mm. in length, so it is not closely related to that species.

Muttkowski in 1915, p. 60, states: "It appears to me that an identity of this form [*costalis*] with *T. canis* as an aberration of the latter, is not a too far fetched assumption." In his 1911 description of the type of *costalis*, Kirby states that there are "4 antenodals and 7 postnodals on hind wing." In *canis* the hind wings generally have 5 antenodal cross veins according to Dr. Needham, and I also find that to be the case in the specimens I have examined. Also the female appendages do not appear to exceed 3 mm. in length and are not straight, nor 4.5 mm. long, as described in *costalis* by Kirby. It appears, therefore, that Muttkowski's surmise in 1911, that *costalis* is more nearly related to *spinigera*, may be correct. However, as we know the species *spinigera* has not yet been found as far south as Georgia. In wing markings *costalis* and *petechialis* appear to be somewhat alike.

EXPLANATION OF PLATES

PLATE IX

- Fig. 1. *Tetragoneuria cynosura* Say. Concord, Mass. (R. Heber Howe, Jr.)
- Fig. 2. *Tetragoneuria cynosura* subsp. *simulans* Mutt. Bluffton, Ind. (E. B. Williamson.)
- Fig. 3. *Tetragoneuria semiaquea* Burmeister. Southern Pines, N. C. (A. H. Manee.)
- Fig. 4. *Tetragoneuria stella* Williamson. Rockledge, Fla. (Mrs. C. C. Deam.) Williamson Collection.
- Fig. 5. *Tetragoneuria petechialis* Mutt. Paratype. Cypress Mill, Texas. Collec. Acad. Nat. Sci., Philadelphia.

PLATE X

- Fig. 1. *Tetragoneuria williamsoni* Mutt. Type. Wister, Okla. Williamson Collection.
- Fig. 2. *Tetragoneuria williamsoni* Mutt. Tampa, Fla. (E. L. Bell.) Davis Collection
- Fig. 3. *Tetragoneuria morio* Mutt. Concord, Mass. (R. Heber Howe, Jr.) Williamson Collection.
- Fig. 4. *Tetragoneuria spinigera* (Selys). West Point, N. Y. (Wm. T. Davis.) Davis Collection.
- Fig. 5. *Tetragoneuria spinigera* (Selys). Squam Lake, N. H. (R. Heber Howe, Jr.)

PLATE XI

- Fig. 1. *Tetragoneuria spinigera* var. *suffusa* Davis. Type. Newfoundland, N. J. (Wm. T. Davis.) Davis Collection.
- Fig. 2. *Tetragoneuria spinigera* var. *suffusa* Davis. Hudson Highlands, N. Y. (F. M. Schott.) Davis Collection.
- Fig. 3. *Tetragoneuria spinosa* (Hagen). Clementon, N. J. (V. A. E. Daecke.) Davis Collection.
- Fig. 4. *Tetragoneuria spinosa* (Hagen). Old Bridge, N. J. (Wm. T. Davis.) Davis Collection.
- Fig. 5. *Tetragoneuria canis* MacLachlan. Napa, Calif. (C. H. Kennedy.) Williamson Collection.